

Application No. 10/635,647
Amendment filed June 14, 2004
Reply to Office Action dated March 12, 2004

Attorney Docket No. 030681-568
Page 2 of 7

Amendments to the Specification:

Please REPLACE the paragraph beginning at page 1, line 24, with the following:

Since a high-voltage electrical field is created around micro-tips in such FEDs, there is the risk of electrical arcing events. Although the cause of electrical arcing is not clearly identified, discharging caused by a sudden large amount of outgassing seems to cause the electrical arcing. According to an experiment result, such arcing occurs with application of an anode voltage as high as 1kV for both a FED placed within a high-level vacuum chamber without a faceplate, or as a FED vacuum-sealed with a faceplate, as shown in FIG. 1. According to a result of optical microscopy, damage caused by the arcing is mostly detected at the edges of the gate 6a of the gate electrode 6. This is considered to be caused by a strong electric field created near such sharp edges of the gate 6a. An electrical short occurs between the anode 7 and the gate electrode 76 6 due to the arcing. As a result, a high-anode voltage is applied to the gate electrode 6, thereby damaging the gate insulation layer 4 below the gate electrode 6, and the resistor layer 3 exposed through the well 4a. This damage becomes serious as the anode voltage level increases.

Please REPLACE the paragraph beginning at page 4, line 26, with the following:

The present invention will now be described more fully with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. Referring to FIG. 2, which is a plan view of a field emission device (FED) according to the present invention, a cathode 120 and a gate electrode 160 are arranged in a x-y matrix at the center of a substrate 100, and a focus gate electrode 190 that is a feature of the present invention is arranged over the cathode 120 and the gate electrode 160. The cathode 120 and the gate electrode 140 160 are electrically connected to pads 121 and 161, respectively, arranged on the edges of the substrate 100.

Application No. 10/635,647
Amendment filed June 14, 2004
Reply to Office Action dated March 12, 2004

Attorney Docket No. 030681-568
Page 3 of 7

Please REPLACE the paragraph beginning at page 5, line 7, with the following:

Portion A of FIG. 2 is enlarged in FIG. 3. As shown in FIG. 3, the focus gate electrode 190 has a focus gate 190a through which the cross-overlapped portion of the cathode 130 120 and the gate electrode 160 is exposed. In particular, the gate electrode 160 with the gate 160a is exposed through the ~~post~~ focus gate 190a. The focus gate electrode 190 is located such that the cross-overlapped portion of the cathode 120 and the gate electrode 160, i.e., corresponding to a single pixel, is exposed through its focus gate 190a. The distance between the gate electrode 190 and the pads 121 and 161 are determined in the range of 0.1-15 mm, such that the gate electrode 160 and the cathode 120 are fully covered with the focus gate electrode 190. The focus gate electrode 190 is electrically coupled with an external ground, thereby providing electron emission when an arching occurs with a high voltage. As a result, the underlying layers can be protected from damage.

Please REPLACE the paragraph beginning at page 6, line 1, with the following:

A gate electrode 160 with a gate 160a aligned with the well 140a is formed on the gate insulation layer 140. A focus gate insulation layer 191 is formed on the gate electrode 160 with polyimide, and the focus gate electrode 190 mentioned above is formed over the focus gate insulation layer 191. The focus gate electrode ~~191~~ 190 is formed of Al, Cr, Cr/Mo alloy, Al/Mo alloy, or Al/Cr alloy. The focus gate insulation layer 191 has an opening corresponding to the focus gate 190a of the focus gate electrode 190.